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Foreign Outsourcing of the U.S. Electronics Industry

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ABSTRACT

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During the 1970's and 1980's, there was a significant loss of US electronic manufacturing capability to off shore locations particularly in Asia. There has been considerable literature devoted to the macroeconomic factors written over the last few years. This paper examines some of the industry dynamics and microeconomic factors which contributed as much as the macroeconomic factors to the off-shore migration of manufacturing.

The electronics industry continues to demonstrate significant growth and profitability and its long term growth prospects are enormous. However, US firms have exhibited corporate strategies, structures and decision processes which have made them less competitive than their global competitors. This lack of competitiveness became obvious to even the casual observer during the 1980's. Industry has begun to respond with a management renaissance of initiatives such as Total Quality Management, Just-in Time inventory techniques, and others. However, much more remains to be done in the areas of long-term corporate strategy and decision support systems.

Recent indications are that the industry's efforts have begun to achieve improved competitiveness.

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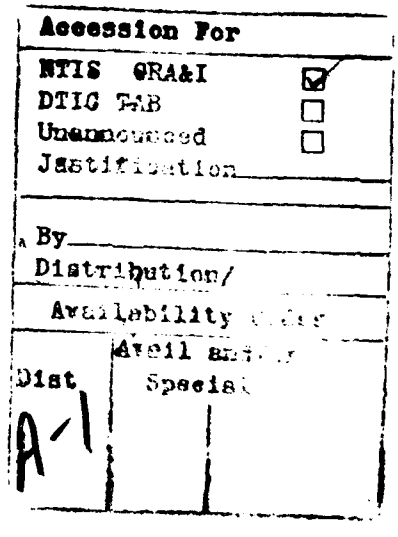

Introduction

The electronics industry has been since 1945, and remains today, one of the fastest growing sectors of the global economy. It is the quintessential 'high tech' industry to which all the pundits and politicians in all nations point as a key to the future of industrial power in the 21st century. The reason is that electronics are an increasingly large portion of all commercial, industrial, and military products and systems. The industry is also a major source of employment. All this focus makes the electronics industry extremely competitive on a worldwide basis. The industry is driven by an increasingly rapid turnover of technology and product innovation and requires large amounts of capital for each succeeding generation of technology.

During the 1970's and 1980's, a significant amount of US electronic manufacturing moved off-shore. This movement included US manufacturers moving their manufacturing operations off-shore, US manufacturers outsourcing manufacturing operations of components and entire products to foreign firms, and the capture of US market share by foreign firms. The current conventional wisdom blames the predatory tactics of our competitors and ineffectual US government macroeconomic policy and action for this loss of US manufacturing capability.

While the macroeconomic factors played a significant role, the dynamics at the microeconomic or individual firm level have contributed as much to the off-shore migration of US manufacturing capability. The purpose of this paper is to examine the micro-

economic dynamics facing the industry, how they contributed to the off-shore migration of US manufacturing, and to assess how new management strategies and techniques can support the continuing global competitiveness of American industry.

THE INDUSTRY

The electronics industry represents a diverse grouping of manufacturers. The Department of Commerce Standard Industrial Code (SIC 36) includes manufacturers of electronic components such as semiconductors (SIC 3674) ; electronic assemblies such as printed circuit boards (SIC 3671-2 and 3675-9); sub-systems such as power supplies; and the capital equipment to produce all these components. At the same time a more diverse definition of the electronics industry would include the downstream original equipment manufacturers (OEMs) of such items as consumer electronics (radios, TVs etc - SIC 365), computers (SIC 357), telephones (SIC 366), and a host of other products. Lastly are the systems integrators - those manufacturers that assemble electronic assemblies, components and sub-systems into larger complex systems such as radars.[1]

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[1] One of the difficulties in analyzing statistics on this industry is in determining just what firms or sectors are being included in the discussion, For example, IBM is normally classified as a computer firm but its also the largest US producer of semiconductors, an electronic item. Intel Corp. is classified as an electronics firm but its predominant product lines, microprocessors and Dynamic Random Access Memories (DRAM) are the heart of personal computers and workstations.

Table I. Fortune 500 Electronics Sector Performance, 1987-1992

Year	Sales $M	Profits $M	Assets $M	Stockholder Equity	Market Value
1987	195,603	10,855	182,215	78,544	158,517
1988	167,722	9,232	211,339	59,321	117,851
1989	184,686	9,960	242,249	64,484	141,070
1990	196,492	8,990	276,123	67,832	146,142
1991	188,298	5,656	284,923	64,436	165,386
1992	194,259	6,172	304,913	70,540	198,629

The historical performance of the electronics industry over the last six years is reflected in the performance of the Fortune 500 electronics firms (Table 1). In 1992, US industry rebounded from the weak performance of the recession plagued previous year by posting a five percent increase in sales and a 20 percent increase in corporate profits (The Corporate Scoreboard, 103). The electronics industry as a whole reflected the same general overall performance - a four percent increase in sales and a 23 percent increase in profits. The semiconductor sector of the industry posted an even sharper turnaround in 1992 with a thirteen percent increase in sales and a 159 percent increase in profits over the previous year (ibid, 107).

It is estimated that by 1995, electronics will represent over 15% of the cost of an average automobile (Standard and Poors, E18). In the defense sector, the value of the electronic content of new weapon systems such as the Air Force Advanced Tactical Fighter (F-

22) is expected to approach 50 percent of the total cost of the system. New electronics based products continue to be introduced at a dazzling rate. World-wide cellular telephony, new generations of personal computers and workstations, and the introduction of digital broadcast radio and high definition television (HDTV) are only some of the new products which will drive the industry in the near future. The worldwide market for semiconductors, the heart of these electronic products, is estimated to grow from $57.2 billion in 1992 to $77.3 billion in 1995 (U.S. Industrial Outlook 1993, 15-4).

Concern for the Future

While the prospects for growth are enormous and US companies are at the forefront of many of these new developments, there remain serious concerns that US industry and the US economy as a whole will not be in a competitive position to fully benefit. Concerns over erosion of the manufacturing base stem from the fact that over the last twenty years there has been a significant migration of the US manufacturing capability to overseas locations. The overall trade deficit in the electronic components sector of the industry grew in 1992 over 100 percent to $ 6.6 billion (Department of Commerce (15-5). Over 65 percent of the electronic component imports came from Japan and the newly industrialized countries (NIC) of East Asia (ibid).

Of even greater concern is the loss of jobs. In 1992, the electronics and computer industries together provided almost 18

percent of all US manufacturing jobs (Industry Overviews 254). Since 1987, the Fortune 500 electronics companies have reduced employment approximately 35 percent against a decline in employment for the entire Fortune 500 of only ten percent.[2]

There is also great concern over the success of Japan and the "Asian Tigers" (Hong Kong, Korea, Malaysia, Singapore, and Taiwan) in capturing market share both in the US and in the world-wide electronics markets. Japanese firms control approximately 16 percent of the US merchant market for electronic components and 11 percent of the total US electronics market (Standard and Poors, 18). Japanese and Korean firms also dominate the consumer electronics market as well as the semiconductor DRAM market. The question is how did US firms - inventors of the technology and dominant in the industry through the 1960's and 1970's - lose their dominant position ? - and how can they meet the global competitive challenge of the twenty-first century?

The Dynamics

The emerging global marketplace complicates an assessment of the dynamics of the health of the industry. Electronics even more than most manufactured goods represent a long value chain from individual component to final end item. The flow of components and goods through the global web of multi-national corporations and

[2] Derived from industry data contained in "The Fortune 500" *Fortune*, April 25, 1988 and April 19, 1993.

global manufacturing[3] reflect an interdependence among US firms and their worldwide counterparts that goes beyond the concept of trade. The global web is really a "form of horizontal and vertical integration across national boundaries" (Gilder 358). Robert Reich in *The Work of Nations* eschews the notion of equating the importance of firms to the US economy with their national ownership. "The standard of living of Americans ... is coming to depend less on the success of the nation's core corporations and industries..than it is on the worldwide demand for their skills and insights" (Reich 77). The question it raises is - what is a US Corporation and does it matter?

While all the body of statistics and trends are certainly useful they don't provide sufficient information upon which to base either policy or strategy. Like all industries, the health of the electronics is affected by a myriad of factors at both the macroeconomic as well as microeconomic level. US trade policy, fiscal policy, tax policy etc. all exert a force on the individual companies. At the level of the individual firm such dynamics as management strategy, financial health, decision support systems can have either a reinforcing or countervailing impact.

An examination of the macro- and micro-economic dynamics behind the erosion of US manufacturing capability shows a number of factors that have had a significant negative impact. Negative in the sense that the ultimate result, the outsourcing of an operation

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[3] Global manufacturing refers to the production of components and subsystems in different countries and assembly operations in another.

or product, or the result of a US government trade action, was not ultimately in the best interests of the firm or the overall health of the US economy. The reason for this is that the dynamics are complex - some reinforce each other while others are countervailing. Also because of the complex value chain, what may be beneficial to one sector of the industry may actually be detrimental to another. An action taken may produce a totally unexpected and undesired outcome. A classic example is the trade action on flat panel displays. The US government imposed a tariff on imported flat panel displays in response to an anti-dumping action by the fledgling US industry. The intent was to nurture an on-shore capability. The result was that US laptop computer manufacturers moved their production facilities off-shore.

Reading the literature through the 1980's and early 90's it seems as if the global competition was a totally one sided contest. On the one side were the predatory Japanese firms and the other Asian nations and on the other side were the poor, hapless American companies. The problem with most of the literature is that it addresses the problems of closed Japanese markets (legitimate), the formidable government-industry cooperation (real, but over estimated), and the fact that the Japanese firms have 'targeted' certain industries as part of their industrial strategy (legitimate). These authors then make a leap to blame US industrial decline on these factors. They attribute the decline of US manufacturing to these factors as if all the problems with US industry were the fault of the Japanese. The problem with the

focus of most of the literature is two-fold. First it ignores the fact that this is a two-sided competition - that ultimately companies compete not governments. While Japanese business practices have created structural impediments to US firms attempting to do business in Japan, those impediments do not explain the loss of market share in the US or worldwide to these same firms. The analysis also does not explain why these off-shore firms have been able to establish viable, profitable manufacturing facilities in this country.

The electronics industry is driven by an increasingly rapid turnover of technology and products. Electronics manufacturing technology, particularly for components and sub-assemblies, is extremely complex, capital intensive, and dependant on economies of scale for economic viability. While funding for research and development has generally been available from multiple source including venture capitalists or 'angels,' the much larger amount of funding necessary to transition from R&D to production has not been available[4]. It has been estimated that production facilities for succeeding levels of technology in the semiconductor industry will approximate $600 million to $900 million (Department of Commerce 15-3). Consequently, small leading edge firms have not been able to generate the capital investment necessary to finance the high cost of the transition to large scale production. As a

[4] Department of Commerce Industry Outlook 1993 - Venture Capital Sector estimates a reduction of annually available capital from $4.2B in 1987 to $1.3B in 1991. In 1991, $734M of the $1.3B was loaned to fund expansion of 475 different firms - or less than $2M each on average.

result they either licensed their technology outright or sought a strategic alliance with a larger firm usually a foreign one.

The good news is that the industry dynamics are constantly shifting. The factors behind the migration off-shore include the macroeconomic factors determining the business climate such as capital availability, trade policy, the deficit, etc. The other dynamics are microeconomic factors which create the corporate view of the world. These factors are dynamic because they are continually in flux - i.e. they tend to be self-adjusting as firms react to them, to the market and to the global economic environment in order to be competitive. The microeconomic dynamics behind the shift to overseas production involve the conscious decisions by corporate executives about corporate structure, strategy, capital budgeting, and outsourcing. These decisions at the level of the firm have been a major factor in the trend to off-shore outsourcing.

CORPORATE STRUCTURE

The historical nature of the US electronics component industry has been entrepreneurial. The industry has been characterized by a mix of both large vertically integrated firms (e.g. IBM, AT&T) and a much larger number of small entrepreneurial firms that have been on the leading edge of technology.

In general, these smaller firms have been financed with private venture capital and have been the source of many of the innovations in the electronics industry. These small dynamic

entrepreneurial companies generally do not have the resources or access to capital to transition to mass production. However, these small firms spent on average 18.4 percent of equity on R&D in contrast to an average rate of 7.5 percent for the entire Fortune 500 (Department of Commerce 50-2). US companies driven by their investors or the stock market are notorious for maintaining a focus on short term profits - therefore they license or swap technology or sub-contract manufacturing to Japanese and other Asian firms.

Many of the larger firms have also been at times either reluctant, inefficient, or unable to make the capital investment for transition to low-cost, high quality production. One of the important organizational factors behind this trend has been the inclination in the US away from vertical integration and toward specialization based on cost efficiency. This is a reaction to, and a result of, the ill-starred diversification that many firms pursued in the 1970's in lieu of reinvesting in their core business and the merger-mania of the 1980's. Short of cash, these companies have relied on outsourcing or strategic alliances with foreign suppliers in lieu of developing, expanding or modernizing an in-house manufacturing capability. The smaller entrepreneurial firms resorted to licensing of their technology most often to overseas manufacturers.

The problem is that the association of R&D with manufacturing facilitates the use of concurrent engineering - the design for ease of production as well as the designing in of quality. The use of concurrent engineering also reduces product development time which

conveys a distinct advantage in a dynamic market. Separation of the R&D and production functions not only makes this more difficult it also breaks the feedback loop from production to R&D for the next generation. A recent study of historical investment data compared differences in long-term productivity growth. Investment in production equipment was the biggest factor by far, accounting for 80 percent of the difference between a growing healthy growing economy and a declining one (Faltermayer, Invest 42).

THE PROBLEM

The Japanese in the early 1960's targeted manufacturing process technology. Using the financial resources of their unique government-industry and banking relationships, they were able to generate sufficient capital to develop low-cost, high quality manufacturing capabilities. Many commentators have identified low labor cost for the competitive advantage of Japanese firms over US facilities or the reason why US manufacturers moved operations off-shore. Even in the 1960's and 70's. the initial overseas labor cost advantage of up to 15 percent was never able to overcome the approximately 18 percent cost disadvantage of imported goods due to tariffs and additional shipping and handling inherent in overseas manufacturing (Dertouzos 223).

Corporate Strategy

In the late 1970's and early 1980's it became apparent even to

the casual observer that something was wrong with American business. Statistics on market penetration in the US and world-wide markets by Japanese and other Asian automobile and electronic firms showed an increasing market share captured by those firms. The overall competitiveness of US firms came into question. US products in many cases did not measure up to the quality standards of these new competitors. At the same time US management at many firms seemed almost hell-bent to get out of the manufacturing business as they outsourced more and more of their product line.

In the face of a heavy onslaught of DRAM's produced by the Japanese, US manufacturers almost abandoned the Semiconductor DRAM market. Recently US companies such as Motorola have begun to recognize that there is a strategic advantage to manufacturing DRAMs because they are the most efficient way to master critical production skills necessary in the succeeding generations of higher margin product lines (Faltermeyer, 72). Both trends have led to not only the transfer overseas of potential jobs and manufacturing capability but also to a transfer of the basic technology. The result is that many of these foreign firms have become competitors on the succeeding generation of technology.

As a response to this assessment US management began implementing the alphabet soup of management science. TQM (Total Quality Management), JIT (Just In Time) inventory, MRP (Manufacturing Resources Planning), BPR (Business Process Reengineering), and EI (Employee Involvement) were implemented by firm after firm. The results in most cases have been dramatic

particularly with regard to increases in quality and reduction of cost.

The requirement for a management renaissance is not over yet. Despite all the improvements achieved by the new management initiatives, problems still remain. Management decisions on outsourcing and capital budgeting, although justified by the appropriate models, have not reversed the trend toward outsourcing despite a clear increase in the competitiveness of US products. The problem appears to lie in the accuracy of the data, particularly product cost data, provided to management. There is a growing body of studies that indicate that traditional accounting systems are not providing management the necessary accurate data to base sound capital investment and outsourcing decisions. The response to this problem being advocated by a variety of experts is ABC or activity based cost-accounting.

Automated Manufacturing

The previous paradigm of industrial manufacturing achieved low-cost through specialization and economies of scale. Manufacturing operations were reduced to simple repetitious tasks. The direct labor associated with the process was considered the primary factor to control. The Economic Order Quantity model was king and the cost of holding inventories was balanced against the cost of production start-up to determine the optimum batch size. The financial accounting system was designed to value inventories. However, with the inexorable march of technology and the

requirements of the global marketplace the paradigm has changed. The new paradigm requires low-cost, high quality, customized products. The whole mix of the factors of production has been upset with the advent of automated production lines and the importance of technology and knowledge factors. The holy grail, so to speak, is now the'lot size of one.' Traditional accounting systems designed for the old paradigm are no longer able to cope with these new changes. A new system of determining the true cost is required.

TRADITIONAL ACCOUNTING SYSTEMS

Direct labor was considered the primary metric under the old cost management paradigm because it was the largest variable factor. Management was focused on controlling it and reducing it. Product cost data was accumulated based on direct labor and the support costs, or overhead costs, were allocated to the product on a simple percentage basis. The assumption that the support costs varied with direct labor worked as long as the direct labor was a large component of product costs and the support costs did not vary too much with product type. The problem is that as the direct labor involved in manufacturing became smaller and smaller the factory overhead became an increasingly large part of the cost. The effect is that the resultant product costs are distorted and do not reflect the true cost to the company. The traditional cost systems tend to grossly overcost high-volume, core products while under-costing low-volume, specialty products. According to Gary Gienger, a senior consultant at Ernst and Young, product cost distortions

can approach 200 percent for low-volume, engineering intensive products ("The New Revolution in Cost Accounting" 37). Product cost data are key inputs to make-or-buy and capital budgeting models. Naturally distorted product cost data has lead to some poor management decisions about whether or not to outsource products and components.

Decision Support Systems

Activity-based cost management has been proposed as the solution to the problem of product cost distortion. ABC seeks to allocate the traditional overhead pool to individual products based on activities and cost drivers. ABC is a complex system requiring a detailed analysis of the activities involved in the manufacturing process. Each product or service is broken down into the individual activities of which it is composed. The focus is on determining the value-added of the activities and their cost. This process value analysis (PVA) is in many respects similar to the flow-charting required by the TQM and focused factory concepts. In addition to eliminating waste and refocusing on value-added activities, ABC seeks to accurately identify cost-drivers and allocate costs to specific activities and their associated products. The result is not only more accurate product cost data but a management focus on the real cost-drivers of the manufacturing process. ABC provides the data to support continuous improvement.

More importantly, there has been a fundamental change in the mix of the factors of production. With the increasing use of

automated manufacturing, the direct labor content of most manufacturing processes is low and getting lower. The Japanese and the other "Asian Tigers" did develop a comparative advantage from advanced technology and economies of scale in many manufacturing processes. However, in retrospect, it still did not justify many of the outsourcing decisions of US firms. US manufacturers continued to outsource more and more of the content of their products to the point that they were either no longer economically viable or became "hollow corporations."

The consumer electronics industry is a prime example. In 1960 virtually 100 percent of US color TV market was controlled by US owned on-shore manufacturers. By 1990, Zenith was the last US owned TV manufacturer with any on-shore manufacturing capability[5]. Ironically, at the same time, the Phillips Corporation built in Ohio the largest television factory in the world. The question then is why did US corporate management elect to abandon manufacturing in the US at the same time their foreign competitors were establishing successful enterprises.

From recent studies it appears that two factors contributed heavily to the poor management decisions in many firms that led to the current situation (Davis 60) . First, there was a general lack of strategic vision by management and a focus on near term returns. Long term capital investments entail more risk. Therefore the market requires a clear understanding of the long-term payoff and

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[5] In actuality over 50 percent of the TV's sold in this country are manufactured in the US by foreign firms.

management strategy to achieve it. The easier approach is to focus on short-term performance which mitigates large scale investment. Rather than develop or maintain an in-house capability many firms outsourced first the production and then the development of key strategic components of their products. A recent survey of US CEO's shows that foreign outsourcing could approach 50 percent by 1995 (Bettis 9). By failing to recognize the strategic importance of many components to their core business and the inherent synergy of R&D with the production process, managers have either hollowed out their firms or given away their competitive edge on the next round of competition.

Second, traditional cost accounting systems did not in many cases provide accurate data into the decision process. The traditional cost accounting methodology pools overhead costs and allocates them over the entire firms product mix based on a specific parameter such as direct labor. However, with the high capital-low direct labor content of current manufacturing processes, the underlying assumptions of traditional accounting systems which impute a linear relationship between direct labor and the 'overhead' begin to break down. The result is a distortion of product cost information.

The general trend was to outsource the high volume commodity-type products and maintain in-house the high-technology but low-volume items. The problem is that traditional accounting systems tend to undercost these low-volume items by up to 200 percent ("The New Revolution in Cost Management", 57). Several studies also

reveal that many of the costs involved in overseas outsourcing such as currency exchange rates were never incorporated in the make-or-buy decisions at many firms (Davis 64). The result of these two trends has been a strong tendency for firms to outsource components, products and assembly operations that should have been retained in-house even on a pure cost basis. These factors have exacerbated the macro-economic factors such as capital shortages and structural factors such as the size of the firm.

Management Responds

The decade of the 1980's saw the emergence of a plethora of new management techniques - total quality management, just-in-time inventory, manufacturing requirements planning, business process re-engineering, employee empowering, just to name a few. All these techniques look to address the requirement to remain competitive in a dynamic manufacturing environment. The old mass-production paradigm has almost become an anachronism particularly for the electronics industry. Henry Ford, the most famous father of mass production, is reputed to have said about the Model T that 'you can have any color you want - as long as it is black.' Today the paradigm has shifted. The trend is toward customized products for different markets, small lot sizes, and an ever decreasing product introduction cycle. These new trends require a much more flexible manufacturing process. Capital investment remains critical but even more important, the capital equipment and processes must be

flexible to adjust to new technologies and products. Increasingly the cost of manufacturing a product is not in the direct labor or in many cases not even in the raw materials. Rather it is in the design and distribution of knowledge based products. There is a fundamental set of changes coursing its way slowly but inexorably through the business community - lead by the recognition of quality and customer focus under the TQM principles and followed by other changes such as just-in-time inventory, business process reengineering and activity-based cost accounting. Those firms that are embracing this new set of paradigms are beginning to show renewed vigor, market-share gains, and most important profitability.

In the end its companies that compete - firms that succeed or fail based on their ability to compete. A new stream of increasingly sophisticated technologies and products is one thing but it won't solve the basic competitiveness problems of American firms without adequate investment in the technology and processes to manufacture.

Current Trends

The electronics industry continues to enjoy a growth pattern exceeding the general growth in the economy. Electronic component manufacturers have enjoyed pre-tax profit margins exceeding 20 percent over the last three years. Electronic equipment manufacturers also have enjoyed profit levels over 15 percent for

Table II Manufacturing Partners of US Design Firms.

Chip	Designer	Partner
ALPHA	Digital Equipment	Mitsubishi
MIPS R SERIES	Silicon Graphics	NEC,LSI Logic,Siemens, Toshiba
POWERPC	IBM	Motorola
PRECISION ARCHITECTURE	Hewlett-Packard	Hitachi,Samsung,Oki, Winbond
SPARC	Sun Microsystems	TI, Cypress, Fujitsu, LSI Logic
PENTIUM	Intel	None

the last three years. The US also continues to enjoy a competitive advantage in technology but it is no longer large or uniform across the board. Recent trends indicate that many firms are beginning to reassess their previous strategies, or lack thereof, and to make the necessary investment in manufacturing technology. A recent announcement in the *Wall Street Journal* cites Intel Corp. as the leader of all world-wide semiconductor firms in capital investment. IBM despite its current travails is making the management and organizational changes to improve its competitive advantage in many of its product lines. US industry has begun to take stock of its situation and to take action to protect its competitive advantage - to in effect become global competitors. The bottom line is that those firms and industries that forge themselves into global competitors will survive and prosper while those that don't will not survive.

FUTURE TRENDS

New consumer products as well as the increasing electronic content in automobiles will continue to drive demand for both electronic components and equipment. Defense requirements for electronics while stable only represent four percent of the total US market and will only influence the industry at the cutting edge of technology. Generically the trend is to reduce the size of electronic components and equipment and to increase both speed and capability (Table II). As the size and complexity of components increase new manufacturing technologies and capital investments will be required. US companies have reversed the trend to increase the size of their investment in manufacturing process technology for current and next generation components.

Table II: Technology Dynamics of the Intel Microprocessor (Brandt 95)

Chip	Release Date	# Sold to Date *	Projected Sales **	Number of Transistors	MIPS ***
286	1982	37	.8	130,000	1
386	1985	49	39	275,000	5
486	1989	13	75	1,200,000	20
Pentium	1993	--	5.4	3,100,000	100

* Unit sales through 1992 (millions)
** Unit sales projected 1993 through 1996 (millions)
*** Millions of Instructions per second -a measure of performance.

Role of Government

Firms ultimately must compete with firms in the global marketplace - government cannot create competitive industries, firms must do so (Porter 620). To be successful government must pursue policies that create an environment in which firms can gain competitive advantage rather than involve government directly in the process. "By stimulating early demand, confronting industries with the need for frontier technologies through symbolic cooperative projects, establishing prizes to highlight and reward quality, encouraging rivalry, and other policies, the pace of innovation and upgrading is accelerated" (Porter 620).

Government should play a role only in those areas where firms are unable to act such as Trade Policy or where externalities cause firms to underinvest. Necessity is the mother of invention and firms are no different - global pressure and a sense of urgency are key elements of national competitive advantage.

The competitive advantage of the US electronics industry stem from ever increasing productivity, a steadily increasing level of technology, a stream of product innovation, investments in building close customer ties, and economies of scale that arise from a global market.

Competitive advantage is built up over a long period of time - unfortunately both the stock market and government are focused on the near term either quarterly profits or today's economic fluctuation.

CONCLUSION

The offshore migration of US electronic manufacturing capability over the last twenty years is the result of a confluence and interaction of many factors. Macroeconomic factors such as the government budget deficit, economic recessions, and government regulation have had a direct impact as they made it more difficult for industry to cooperate or to generate investment capital. The fragmented nature of the corporate structure of much of the industry has also contributed to the problem of offshore migration. Lack of strategic vision by corporate executives has led to short-sighted decisions not to retain in-house the production of the strategic elements of their products. Lastly, the traditional management decision support systems no longer provide accurate data upon which to base sound outsourcing decisions.

The management of many of the US electronic firms has begun implementing the strategies to achieve long range competitiveness through increased investment and more rapid innovation. However, in a global economy it is a never ending process.

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